We claim:

1. A magnetic recording medium comprising:

a substrate;

a lower magnetic layer structure formed over said substrate, said lower magnetic layer structure exhibiting a Ms greater than 250 emu/cm^3;

an intermediate layer comprising Ru; and

an upper magnetic layer structure formed over said intermediate layer, said upper magnetic layer structure being antiferromagnetically coupled to the lower magnetic layer structure.

2. Magnetic recording medium of claim 1 wherein the Ms of the lower magnetic layer structure is greater than 300 emu/cm^3.

3. Magnetic recording medium of claim 1 wherein said lower magnetic layer structure comprises a layer comprising mostly Co, between 5 and 20 at. % Cr, 0 to 6 at. % Ta, 0 to 10 at. % B and 0 to 10 at. % Pt.

4. Magnetic recording medium of claim 3 wherein said layer of said lower magnetic layer structure comprises between 0 and 10 % X, where X is one or more elements other than Co, Cr, Ta, B or Pt.

5. Magnetic recording medium of claim 4 wherein X comprises one or more of Nb, Ta, Cu, Mo, W, V, Si, C, Pd, Ru, Ir or Y.

6. Magnetic recording medium of claim 1 wherein the upper magnetic layer structure comprises a layer comprising mostly Co, between 10 and 30 at. % Cr, between 8 and 20 at. % Pt, and 0 to 20 at. % B.

7. Magnetic recording medium of claim 6 wherein said layer of said upper magnetic layer structure comprises between 0 and 10 at. % X, wherein X is one or more elements other than Co, Cr, Pt or B.

8. Magnetic recording medium of claim 7 wherein X comprises one or more elements selected from Nb, Ta, Cu, Mo, W, V, Si, C, Pd, Ru, Ir or Y.

9. The magnetic recording medium of claim 1 further comprising an underlayer formed between the substrate and the lower magnetic layer structure.

10. The magnetic recording medium of claim 1 wherein at least one of said upper and lower magnetic layer structures comprise a plurality of layers.

11. The magnetic recording medium of claim 1 wherein a lowest magnetic layer structure is formed above said substrate, a second intermediate layer comprising Ru is formed between said lowest magnetic layer structure and said lower magnetic layer structure, and said lowest magnetic layer structure is antiferromagnetically coupled to said lower magnetic layer structure.

12. A magnetic disk drive comprising the magnetic recording medium of claim 1.

13. A magnetic disk comprising:

a substrate;

a lower magnetic layer structure formed over the substrate;

an intermediate layer comprising Ru;

an upper magnetic layer structure formed over the intermediate layer, said upper magnetic layer structure being antiferromagnetically coupled to the lower magnetic layer structure, wherein the relationship between the dynamic coercivity of the lower magnetic layer structure and the exchange field is such that during writing a portion of the lower magnetic layer structure achieves substantially its steady magnetization state within the time required for one revolution of said disk.

14. The magnetic disk of claim 13 wherein at least one of said upper and lower magnetic layer structures comprise a plurality of layers.

15. The magnetic disk of claim 13 wherein a lowest magnetic layer structure is formed above said substrate, a second intermediate layer comprising Ru is formed between said lowest magnetic layer structure and said lower magnetic layer structure, and said lowest magnetic layer structure is antiferromagnetically coupled to said lower magnetic layer structure.

16. Magnetic disk of claim 13 wherein said magnetic disk is incorporated into a disk drive, said magnetic disk rotating.

17. A magnetic disk comprising:

a substrate;

a lower magnetic layer structure formed over the substrate;

an intermediate layer comprising Ru; and

an upper magnetic layer structure formed over the intermediate layer, said upper magnetic layer structure being antiferromagnetically coupled to the lower magnetic layer structure, wherein the relationship between the dynamic coercivity of the lower magnetic layer structure and the exchange field is such that during writing a portion of the lower magnetic layer structure achieves more than 90% of its steady magnetization state within the time required for one revolution of said disk.

18. A magnetic disk comprising:

a substrate;

a lower magnetic layer structure formed over the substrate;

an intermediate layer comprising Ru; and

an upper magnetic layer structure formed over the intermediate layer, said upper magnetic layer structure being antiferromagnetically coupled to the lower magnetic layer structure, wherein the relationship between the dynamic coercivity of the lower magnetic layer structure and the exchange field is such that during writing a portion of the lower

magnetic layer structure achieves more than 95% of its steady magnetization state within the time required for one revolution of said disk.

19. A magnetic recording medium comprising:

a substrate;

a lower magnetic layer structure formed over the substrate;

an intermediate layer comprising Ru; and

an upper magnetic layer structure formed over the intermediate layer, said upper magnetic layer structure being antiferromagnetically coupled to the lower magnetic layer structure, wherein the relationship between the dynamic coercivity of the lower magnetic layer structure and the exchange field is such that during writing a portion of the lower magnetic layer structure achieves substantially its steady magnetization state within 100 milliseconds.

20. A magnetic recording medium comprising:

a substrate;

a lower magnetic layer structure formed over the substrate;

an intermediate layer comprising Ru; and

an upper magnetic layer structure formed over the intermediate layer, said upper magnetic layer structure being antiferromagnetically coupled to the lower magnetic layer structure, wherein the relationship between the dynamic coercivity of the lower magnetic layer structure and the exchange field is such that during writing a portion of the lower

magnetic layer structure achieves more than 90% of its steady magnetization state within 100 milliseconds.

21. A magnetic recording medium comprising:

a substrate;

a lower magnetic layer structure formed over the substrate;

an intermediate layer comprising Ru; and

an upper magnetic layer structure formed over the intermediate layer, said upper magnetic layer structure being antiferromagnetically coupled to the lower magnetic layer structure, wherein the relationship between the dynamic coercivity of the lower magnetic layer structure and the exchange field is such that during writing a portion of the lower magnetic layer structure achieves more than 95% of its steady magnetization state within 100 milliseconds.

22. Magnetic recording medium comprising:

a substrate;

a lower magnetic layer structure formed over said substrate, said lower magnetic layer structure having a Ku between 0 and 10^6 erg/cm^3;

an intermediate layer comprising Ru formed over the lower magnetic layer structure; and

an upper magnetic layer structure formed over said intermediate layer, said upper magnetic layer structure being antiferromagnetically coupled to said lower magnetic layer structure and having a Ku greater than 10^6 erg/cm^3.

23. Magnetic recording medium of claim 22 wherein said lower magnetic layer structure has a Ku less than 0.5×10^6 erg/cm^3.

24. The magnetic recording medium of claim 22 wherein at least one of said upper and lower magnetic layer structures comprise a plurality of layers.

25. The magnetic recording medium of claim 22 wherein a lowest magnetic layer structure is formed above said substrate, a second intermediate layer comprising Ru is formed between said lowest magnetic layer structure and said lower magnetic layer structure, and wherein said lowest magnetic layer structure is antiferromagnetically coupled to said lower magnetic layer structure.

26. A magnetic disk drive comprising the magnetic recording medium of claim 22.

27. A magnetic recording medium comprising:

a lower magnetic layer structure;

an intermediate layer comprising Ru formed over the lower magnetic layer structure; and

an upper magnetic layer structure antiferromagnetically coupled to the lower magnetic layer structure and formed over said intermediate layer, the dynamic coercivity of the lower magnetic layer structure being greater than or equal to zero but less than the exchange field between the upper and lower magnetic layer structures.

28. Magnetic recording medium of claim 27 wherein said dynamic coercivity of said lower magnetic layer structure is less than one half of the exchange field.

29. Magnetic recording medium of claim 27 wherein said dynamic coercivity is for a recording switching time between 1 and 10 ns.

30. The magnetic recording medium of claim 27 wherein at least one of said upper and lower magnetic layer structures comprise a plurality of layers.

31. The magnetic recording medium of claim 27 wherein a lowest magnetic layer structure is formed above said substrate, a second intermediate layer comprising Ru is formed between said lowest magnetic layer structure and said lower magnetic layer structure, and said lowest magnetic layer structure is antiferromagnetically coupled to said lower magnetic layer structure.

32. A magnetic disk drive comprising the magnetic recording medium of claim 27.

33. Magnetic recording medium comprising:

a substrate;

a lower magnetic layer structure formed over said substrate;

an intermediate layer comprising Ru formed over said lower magnetic layer; and

an upper magnetic layer structure formed over said intermediate layer, said upper magnetic layer being antiferromagnetically coupled to said lower magnetic layer structure, the coercivity of said lower magnetic layer structure as measured in a switching time of 10 milliseconds being less than the exchange field between said upper and lower magnetic layer structures.

34. Magnetic recording medium of claim 33 wherein said coercivity of said lower magnetic layer structure as measured in a switching time of 10 milliseconds is less than one half of the exchange field between said upper and lower magnetic layer structures.

35. The magnetic recording medium of claim 33 wherein at least one of said upper and lower magnetic layer structures comprise a plurality of layers.

36. The magnetic recording medium of claim 33 wherein a lowest magnetic layer structure is formed above said substrate, a second intermediate layer comprising Ru is formed between said lowest magnetic layer structure and said lower magnetic layer structure.

37. A magnetic disk drive comprising the magnetic recording medium of claim 33.

38. Magnetic recording medium comprising:

a substrate;

a lower magnetic structure formed over said substrate, said lower magnetic structure comprising a magnetically soft material with intergranular decoupling;

an intermediate layer comprising Ru formed over said lower magnetic layer structure; and

an upper magnetic layer structure formed over said intermediate layer, said upper magnetic layer structure being antiferromagnetically coupled to said lower magnetic layer structure.

39. Magnetic recording medium of claim 38 wherein said lower magnetic layer structure comprises an alloy selected from the list consisting of permalloy, sendust, CoTaZr, FeTaC, NiFeNb, CoFe, NiCrFe, NiV, CuNi, FeRh and PtMn.